Comparatively analysis of AODV and DSR in MAC layer for Ad Hoc Environment

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Abstract—In Wireless Adhoc Network is a group of wireless mobile nodes is an autonomous system of mobile nodes connected by wireless links. Every node operates as an end system and as a router to forward packets. In this paper mainly focused on Mac layer because this layer is most important for the data communication using control the packet loss and we worked on the comparison based performance of wimax802.16 and wireless802.11 networks using Ad hoc on- demand Distance Vector Routing Protocol and Dynamic Source Routing Protocol. In this paper we used the different maximum speed for the network. And this comparison based on unicast On-demand routing procedure and our simulation for mobile ad hoc networks discover and maintain only needed the design and follows the idea that each node by sending routing packets whenever a communication is requested and compared various parameter packet delivery ratio, normalized routing load and e-e delay. These simulations are carried out using the Network simulator version-2. The results presented in this work illustrate the importance in carefully evaluating and implementing routing protocols in an ad hoc environment.

Key words: AODV, DSR, 802.11, 802.16, Adhoc Environment, NS-2.31.

I. INTRODUCTION

Wireless communication between mobile users is becoming more popular than ever before. This is due to recent technological advances in laptop computers and wireless data communication devices, like wireless LANs. This leads to lower prices and higher data rates; these are two main reasons why mobile computing continues to enjoy rapid growth.

There are two distinct approaches for enabling wireless communication between two hosts. First approach is the existing cellular network infrastructures carry data as carried as voice. The major problems include the problem of handoff that tries to control the situation when a connection should be smoothly handed over from one base station to another base station without packet loss or noticeable delay. Another problem is that networks based on the cellular infrastructure are limited to places where there exists such a cellular network infrastructure.

The second approach is to form an Ad hoc network among all users wanting to communicate with each other. This means that all users participating in the Ad hoc network must be willing to forward data packets to make sure that the packets are delivered from source to destination. This form of networking is limited in range by the individual nodes transmission ranges and is typically smaller compared to the range of cellular systems [1, 4].

Ad-hoc networking is a concept in computer communications, which means that user's wants to communicate with each other form a temporary based network, without any form of centralized administration. Each node participating in the network can acts both as host and a router with willingness to forward packets for other nodes. For this purpose, a routing protocol is needed [6]. In this work Demand Distance Vector Routing have in used. A simulation model feature based on MAC and physical layer models is used to study interlayer interactions, their performance and implications. The performance differentials are analyzed using varying, mobility, network size and network load [2]. These simulations are carried out using the network simulator version 2, which is used to run Ad hoc simulations. The results presented in this work illustrate the importance in carefully evaluating and implementing routing protocols when evaluating an Ad hoc network protocol.

Wireless communication between mobile users is becoming more popular than ever before. This is due to recent technological advances in laptop computers and wireless data communication devices, like wireless LANs and wireless modems. This has led to higher data rates and lower prices, which are the two main reasons why mobile computing continues to enjoy rapid growth.

Unconstrained connectivity Ad hoc networks do not rely on any pre established infrastructure and can therefore be deployed in places with no infrastructure. This is useful in disaster recovery situations and places with non-existing or damaged communication infrastructure where rapid deployment of a communication network is needed [8]. Ad hoc networks can also be useful on conferences where people participating in the conference can form a temporary network without engaging the services of any pre existing network. The WiMAX Forum is an industry body formed to promote the IEEE 802.16 standard and perform interoperability testing. The WiMAX Forum has adopted certain profiles based on the 802.16 standards for interoperability testing and "WiMAX certification" [2]. These operate in different frequency bands, which are typically licensed by various government bodies. WiMAX, is basically based on an RF technology called Orthogonal Frequency Division Multiplexing (OFDM), which is a very effective means of transferring data when carriers of width of 5MHz or greater. Below 5MHz carrier width, current CDMA based 3G systems are comparable to OFDM in terms of performance.

WiMAX is a standard-based wireless technology that provides high throughput broadband connections over long distance. WiMAX could be used for a number of applications, including "last mile" hotspots, broadband connections and high-speed connectivity for commercial purpose. It provides wireless metropolitan area network

(MAN) connectivity at speeds up to 70 Mbps and the WiMAX base station on the average can cover between 5 to 10 km [1].

II. AODV

The Ad hoc On Demand Distance Vector (AODV) routing protocol builds on the DSDV algorithm previously described. AODV is an improvement on DSDV because it typically minimizes the number of required broadcasts by creating routes on a demand basis, opposed to maintain a complete list of routes as in the DSDV algorithm [3]. AODV classified as a pure on-demand route acquisition system, cause nodes that aren't on a selected path do not maintain routing information or participate in routing table exchanges.

When a source node desires to send a message to some destination node and does not already have a valid route to that destination, it initiates a path discovery process to locate the other node [9]. It broadcasts a route request (RREQ) packet to its neighbors, which then forward the request to neighbors, and so on, until either the destination or an intermediate node with a fresh enough routes to the destination is located. AODV used destination sequence numbers to ensure all routes are loop free and contain the most recent route information detail. Each node maintains sequence number and broadcast ID. The broadcast ID is incremented for the every RREQ the node initiates, and together with node's IP address, identifies an RREQ. Along with its own sequence number and the broadcast ID, source node includes the RREQ the most recent sequence number it has for destination. Intermediate nodes reply to the RREQ only if they have a route to the destination whose corresponding destination sequence number is greater than or equal to that contained in the RREQ [5, 7].

During the process of forwarding the RREQ, intermediate nodes record in their route tables the address of the neighbor from which the first copy of the broadcast packet is received, i.e. establishing a reverse path. If additional copies of the same RREQ are later received, these packets are discarded [1, 4].

Once the RREQ reaches the destination or an intermediate node with a fresh enough route, destination intermediate node responds by unicasting a route reply (RREP) packet back to the neighbor from which it first received the RREQ. As the RREP is routed back along the reverse path, nodes along with this path, set up forward route entries in their route tables which point to the node from which the RREP came. These forward route entries indicate the active forward route [3]. With each route entry is a route timer that will cause the deletion of the entry if it is not used within the defined lifetime. Because RREP is forwarded along the path established by the RREQ, AODV only supports the use of symmetric links. If a source node changes the position, it is able to reinitiate the route discovery protocol to find a new route to the destination. If a node along with the route moves, its upstream neighbor notices the move and propagates a link failure message (an RREP with infinite metric) to each of its active upstream neighbors to inform them of the erasure of that part of the route. These nodes propagate the link failure notification message to their upstream neighbors, and continue the process until the source node is reached. The source node then choose to reinitiate route discovery for that destination if a route is still desired [1, 2, 5]

An additional aspect of the protocol is the use of hello messages, periodically broadcasts by a node to inform each mobile node of other nodes in its neighborhood. Hello messages can be used to maintain the local connectivity of a node. Sometimes the use of hello messages is not required. Nodes listen for retransmission of data packets to ensure that the next hop is still within reach. If such a retransmission is not heard, the node may be used available of another technique, including the hello messages, to find out whether the next hop is within communication range. The hello messages may list the other nodes from which a mobile has heard, thereby yielding greater knowledge of network connectivity [4, 8].

III. DSR

DSR is a reactive routing protocol that is determines the proper route only when packet needs to be forwarded. For restricting the bandwidth, process to find a path is only executed when a path is required by a node (On-Demand Routing). In DSR the sender (source, initiator) determines the whole path from the source to the destination node (Source-Routing) and deposits the addresses of the intermediate nodes of the route in the packets. DSR is beacon-less which means that there are no hello-messages used between the nodes to notify their neighbors about their presence. DSR was developed for mobile Ad-hoc networks with a small diameter between 5 and 10 hops and the nodes should only move around at a moderate speed. DSR is based on Link-State Algorithms which mean that each node is capable to save the best way to a destination. Also when a change appears in network topology, then the whole network will get this information by flooding. DSR protocol is composed the two main mechanisms that work together to allow discovery and maintenance of source routes in MANET [8, 9].

IV. SIMULATION

The simulations were performed using Network Simulator 2 (NS-2.31). Constant bit rate (CBR) traffic was used in simulation. Simulation was done by varying Max speed from 20, 25, 30, 35 and 40. The pause time was kept constant at 1.0sec in a simulation and area of 400mX700m. During the simulation, each node started its journey from a random spot to a random chosen destination. Once the destination was reached, the node took a rest period of time in second and another random destination is chosen after that pause time. This process was repeated throughout simulation, due to continuous changes in the topology of the underlying network. The following table gives the simulation parameters used during the simulation [2].

V. SIMULATION PARAMETERS

Parameter	Values
Routing protocol	AODV,DSR
Simulator	NS-2.31
MAC Protocol	802.11 & 802.16
No. of Mobile Nodes	60
Simulation Time	100 Seconds
Packet Size	512 byte

Traffic Sources	CBR
Transmit Power	250 w
Network Area	400m X 700m
Maximum Connection	30
Max Speed	20m/s
Transmission Rate	2.0m/s

Table. 1: Parameters and their results

VI. PERFORMANCE METRICS

The main objective of this paper is comparing the performance of MAC 802.11(wireless) and MAC 802.16 (WiMAX) using on demand routing strategy following metrics.

A. Packet Delivery Fraction

The ratio of the data packets delivered to the destinations to those generated by the CBR sources is known as packet delivery fraction [3].

B. Routing overhead

It gives the total number of routing packets transmitted during the simulation. It is the ratio of routing packets to the total no. of packets generated by the source [3].

C. End-to-End Delay

Network delay is the total latency experienced by a packet to traverse the network from the source to the destination. At the network layer, the end-to-end packet latency is the sum of propagation delay, processing delay, queuing delay and packet, transmission delay. The end-to-end delay of a path is the sum of the node delay at each node plus the link delay at each link on the path [5].

D. Packet loss (%)

Packet loss is the failure of one or more transmitted packets to arrive at their destination [5].

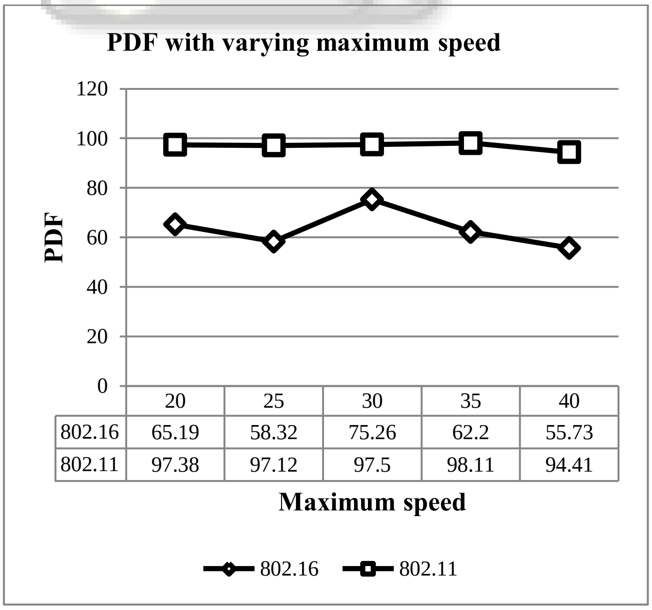

Fig. 1: Graph of PDR using On Demand Uncast Reactive Routing Protocol

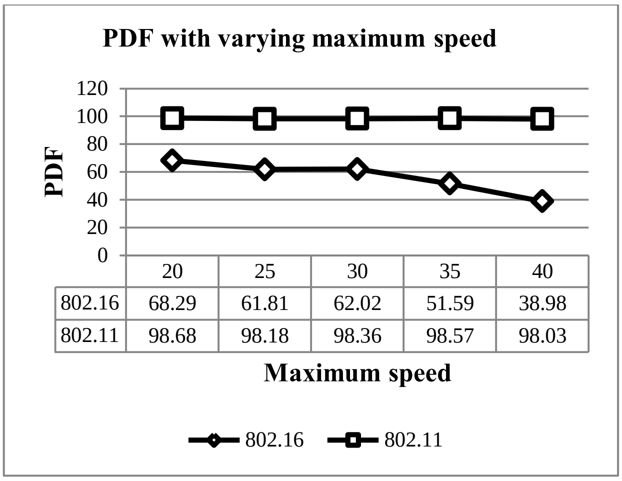

Fig. 2: Graph of PDR using On DSR Protocol

Fig 2-shows that the packet delivery ratio for MAC layer control 802.11 and 802.16 using on DSR. The value of PDF have better for 802.11.

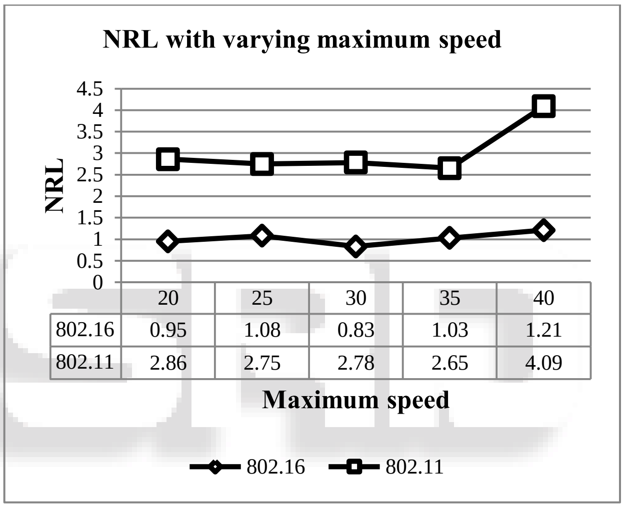

Fig. 3: Network Load for MAC layer control 802.11 and 802.16 using AODV

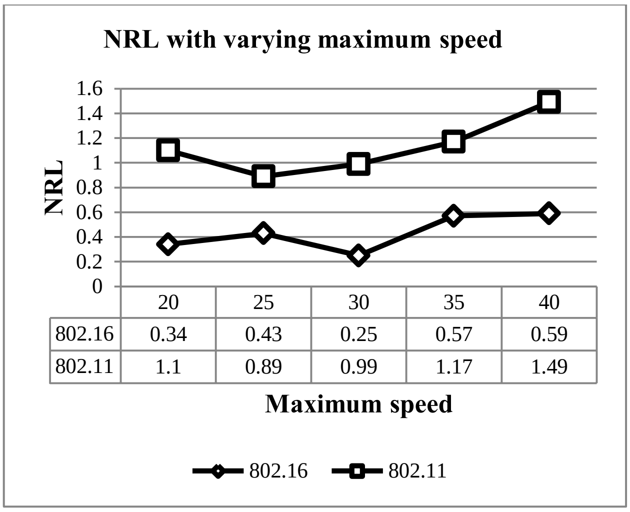

Fig. 4: NRL for MAC layer control 802.11 and 802.16 using DSR.

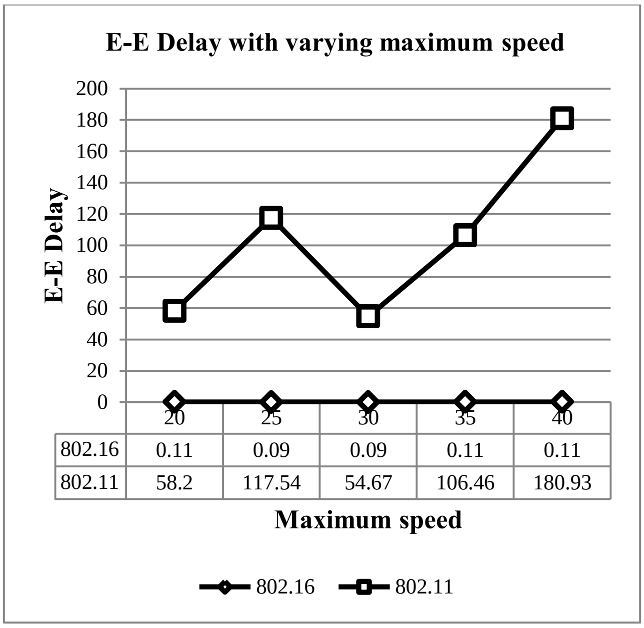

Fig. 5: E-E delay for MAC layer control 802.11 and 802.16 using AODV

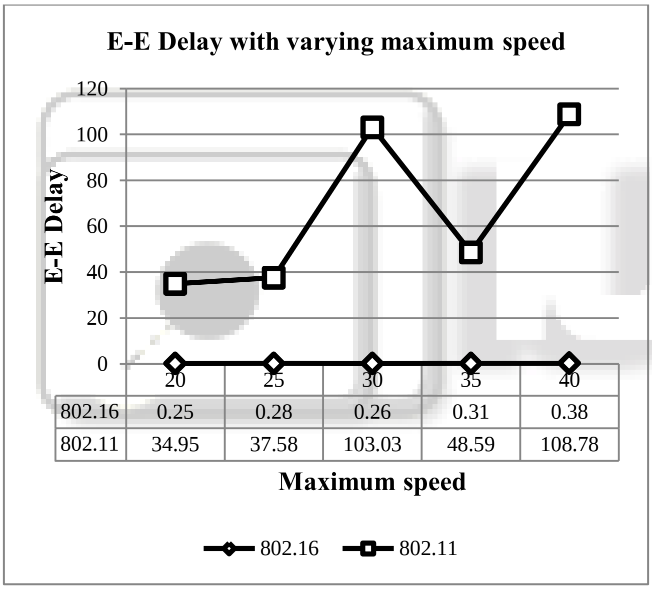

Fig. 6: E-E delay for MAC layer control 802.11 and 802.16 using DSR

VII. CONCLUSION

In this paper we performed the simulation to compare the performance of MAC 802.11 and MAC 802.16 using on-demand AODV and DSR routing protocols on different performance parameters i.e. packet delivery ratio, network load and end to end delay with varying maximum speed. The results show that the performance of wireless is better than WiMAX for small area. The overall performance 802.11 AODV is better than 802.11DSR.

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